

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the application of: Nguyen et al.

Serial No.: 10/824,836

Filed: 04/15/2004

For: LOW LOSS CHALCOGENIDE GLASS AND PROCESS FOR MAKING SAME USING
ARSENIC MONOCHALCOGENIDE

Examiner: Lazorek, Jason L

Art Group Unit: 1731

DECLARATION UNDER 37 C.F.R. § 1.132 OF VINH NGUYEN

I, Vinh Nguyen, hereby declare that:

1. I am a co-inventor of the invention claimed in the above-identified patent application. My position at the US Naval Research Laboratory is research scientist. I consider myself qualified to testify the field of high purity materials. My CV is attached.
2. Attached is a graph comparing the attenuation of two arsenic sulfide glasses made by distilling arsenic monosulfide and sulfur, followed by drawing into a fiber. The arsenic/sulfur ratio in both glasses was approximately the same [approximately 39/61].
3. Line (a) shows the results for glass made by distilling at 750°C in a closed vacuum system, as in Churbanov et al. *J. Optoelectronics and Adv. Mat.*, 3(2), 341-349 (2001). The graph shows several major absorbances. Notably, there is a very large attenuation at about 4 microns due to S-H bonds. These bonds are believed to be formed because arsenic monosulfide decomposes at high temperatures, such as above about 550°C. After decomposition, the sulfur bonds to hydrogen found in the vessel walls. Such decomposition also occurs in other arsenic monochalcogenides.
4. Line (b) shows the results for glass made by distilling at 450°C in an open vacuum system. The absorbance at 4 microns is greatly reduced, as are several other peaks. At this lower distillation temperature, arsenic monosulfide does not decompose and very little S-H is formed. This results in a glass that may be more useful for transmission in the 4 micron range.
5. The open vacuum system enables distillation at the lower temperature. If the system were closed at the low temperature, glass vapors would build up in the vessel to the point where it would be necessary to raise the temperature for distillation to continue, which would cause the described decomposition of arsenic monochalcogenide. In an open system, glass vapor does not build up, so distillation may continue at the low temperature.

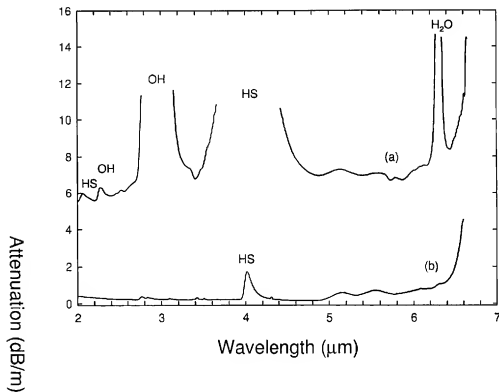
Serial No.: 10/824,836

PATENT APPLICATION
Docket No.: 84830-US1

6. I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

12/11/07
Date

Vinh Nguyen
Vinh Nguyen



The figure shows the comparison between fibers made using (a) high temperature distillation at 750C in a closed system following the processes adopted by literature, and (b) using the disclosed process in the new invention, by distilling at 450C.

Vinh Q. Nguyen

PROFILE

- Fifteen years experiences in materials technology and processing/manufacturing development of advanced materials.

EMPLOYMENT HISTORY

1. Naval Research Laboratory (NRL), Optical Science Division, Washington DC; June 92 to Present. Title: Materials Engineer.

- Provide technical leadership in the Infrared Optical Fiber (IOF) program. The fiber products of this program were delivered to the Infrared Counter Measurement (IRCM) Program. I successfully negotiated with Navy, Army, and Air Force management to obtain funding in support to the IOF program. I also developed a cooperative relationship with Lucent Technology and Corning Inc. and technology transfer agreements between the NRL and CorActive High Tech Inc. to license this technology. Provided technical training and manufacturing support to CorActive High Tech Inc. in Quebec, Canada.
- Provided technical leadership and management in the infrared glasses and optical fibers fabrication. I coordinated and performed analysis at all levels: concept, design, fabrication, cost evaluation, and effectiveness for overall manufacturing systems.
- Evaluated innovative methods to improve overall design and performance of manufacturing processes. I developed strategic plans and solutions to a variety of complex manufacturing problems. Specifically, I have been responsible for developing engineering solutions to processing problems associated with the fabrication of the chalcogenide based glasses.
- Provided technical leadership to junior members of the team. I provided processing guideline and schedule to users for operating the infrared glass facility.

**2. University of California at Los Angeles, Materials Science & Engineering Dept. 10/90-5/92
Graduate Student Researcher**

- Designed and developed two processes to consolidate low-level radioactive waste using a 700 W, 2.45 GHz microwave applicator and various additives such as magnetite (Fe_3O_4), sodium carbonate (Na_2CO_3), lithium carbonate (Li_2CO_3), and boron oxide (B_2O_3).
- Coordinated efforts between UCLA and Los Alamos National Laboratory to develop radioactive material processes meeting EPA requirements.
- Conducted physical property measurements, structural characterizations, and leachability test.

**3. University of California at Irvine, Materials Science & Engineering Dept. 3/88-6/90
Research Assistant**

- Led independent studies and class design projects working in the field of advanced rapid solidification technology.
- Designed a device that injects SiC particulates ($5\text{-}10\text{ }\mu\text{m}$) into a molten aluminum spray. I also designed an atomizer for spraying the molten aluminum. Calculated and measured the nozzle velocity as a function of inlet atomization pressure and inert nitrogen/helium gas.
- Analyzed the particle size distribution of the atomizer as a function of atomization pressure. Measured mechanical properties such as tensile strength and Vicker hardness.

TEACHING EXPERIENCE

1. ClubZHomeTutoring, Fairfax Virginia (<http://www.virginiatutoring.com/>) 1/04-Present

- Pre-Algebra, Geometry, Chemistry, Physic, Trigonometry, AP Calculus tutoring.

2. **University of Maryland, College Park** 9/93-12/98
 - Physic, Chemistry, Math Tutor – General physic, chemistry, and calculus.
 - Engineering Tutor – *Statics, Dynamics, Thermodynamics.*
3. **University of California at Los Angeles, Materials Science & Eng. Department** 01/92-4/92
 - Teaching Assistant – *Introduction to Metallurgical Thermodynamics* course. Explain thermodynamic concepts to undergraduate student. Graded homework.
4. **University of California at Irvine, Mathematics Department** 9/87-6/90
 - Math Tutor and Grader – Calculus. Grade homework and quiz.

AWARDS AND PROFESSIONAL AFFILIATIONS

- Naval Research Laboratory Contribution Award, September 2000 - 2006.
- 2004, 2006 Alan Berman Publication Award at the Naval Research Laboratory.
- 2007 Technology Transfer Award, Code 5606.
- Members of Phi Kappa Phi and Materials Research Society.

EDUCATION

- **Ph.D. in Materials Science and Engineering**, University of Maryland, College Park, May 1999.
Thesis: *Fabrication of low-loss infrared transmitting chalcogenide optical fibers.* GPA: 4.0/4.0.
- **M.S. in Materials Science and Engineering**, University of California, Los Angeles, June 1992.
Thesis: *Immobilization of low-level radioactive waste via microwave heating.* GPA: 3.8/4.0.
- **B.S. in Mechanical/Industrial Engineering**, University of California, Irvine, June 1990. GPA: 3.3/4.0

PATENTS

1. J. S. Sanghera, V. Q. Nguyen, I. Aggarwal, "Process for removing hydrogen and carbon impurities from glasses by adding a tellurium halide," US Patent # 5779757.

PUBLICATIONS (REFEREED)

1. "Nonlinear properties of chalcogenide glass fibers", J. S. Sanghera, I. D. Aggarwal, L. B. Shaw, C. M. Florea, P. Pureza, V. Q. Nguyen, F. Kung, I. D. Aggarwal. J. Optoelectronics and Advanced Materials, Vol. 8, No. 6, December (2006) 2148-2155.
2. "Surface Relief Gratings in AsSe Glass Fabricated Under 800nm Laser Exposure", C. Florea, J. Sanghera, L.B. Shaw, V.Q. Nguyen, and I.D. Aggarwal. Materials Letters vol. 61/6 (2007) p 1271-1273.
3. Characterization of single mode fibers as modal filters for planet finding with nulling interferometers", A. Ksendzov, O. Lay, S. Martin, J.S. Sanghera, L.E. Busse, W.H. Kim, P.C. Pureza, V.Q. Nguyen and I.D. Aggarwal. Submitted to Optics Express 2007.
4. "Estimation of minimum loss in arsenic selenide glass fiber", V. Q. Nguyen, J. S. Sanghera, P. C. Pureza and I. D. Aggarwal. Submitted to Materials Letters.
5. "Nonlinear properties of chalcogenide glass fibers", J. S. Sanghera, I. D. Aggarwal, L. B. Shaw, C. M. Florea, P. Pureza, V. Q. Nguyen, F. Kung, I. D. Aggarwal. J. Optoelectronics and Advanced Materials, Vol. 8, No. 6, December (2006) 2148-2155.

6. "Surface Relief Gratings in AsSe Glass Fabricated Under 800nm Laser Exposure", C. Florea, J. Sanghera, L.B. Shaw, V.Q. Nguyen, and I.D. Aggarwal. *Materials Letters* vol. 61/6 (2007) p 1271-1273.
7. Characterization of single mode fibers as modal filters for planet finding with nulling interferometers", A. Ksendzov, O. Lay, S. Martin, J.S. Sanghera, L.E. Busse, W.H. Kim, P.C. Pureza, V.Q. Nguyen and I.D. Aggarwal. Submitted to *Optics Express* 2007.
8. "Estimation of minimum loss in arsenic selenide glass fiber", V. Q. Nguyen, J. S. Sanghera, P. C. Pureza and I. D. Aggarwal. Submitted to *Materials Letters*.
9. "Formation of a new phase of barium copper sulfur fluoride via sputtering," J. A. Frantz, J. S. Sanghera, V. Q. Nguyen, S. S. Bayya, S. B. Qadri, I. D. Aggarwal. Accepted for publication in *Materials Letter* September 2007.
10. "Photolithographic fabrication of waveguides in sputtered films of GeAsSe glass", D. Turnbull, J. S. Sanghera, V. Q. Nguyen and I. D. Aggarwal, *American Ceramic Society Bulletin*, 82 (9): 9401-9406 September 2003.
11. "Fabrication of waveguides in sputtered films of GeAsSe glass via photodarkening with above bandgap light", D. Turnbull, J. S. Sanghera, V. Q. Nguyen and I. D. Aggarwal, *Materials Letters*, 58 (1-2): 51-54 Jan. 2004.
12. "Fabrication and applications of chalcogenide glass fibers," J. S. Sanghera, I. D. Aggarwal, L. B. Shaw, V. Nguyen, P. Pureza, L. E. Busse, P. Thielen, F. Kung and S. Bayya. Accepted for publication in *Journal of Non-Crystalline Solids*.
13. "Small-core As Se fiber for Raman amplification," P. A. Thielen, L. B. Shaw, P. C. Pureza, V. Q. Nguyen, J. S. Sanghera, and I. D. Aggarwal, *Optics Letters*, Volume 28, Issue 16, 1406-1408, August 2003.
14. "Strength and Fractographic Analysis of Chalcogenide As-S-Se and Ge-As-Se-Te Glass Fibers," J. B. Quinn, V. Q. Nguyen, J. S. Sanghera, I. K. Lloyd, P. C. Pureza, R. Miklos, and I. D. Aggarwal, *J. Non-Crystalline Solids*, 325 [1-3], 150-157, 2003.
15. "Effect of Heating on the Optical Loss in the Arsenic Selenide Glass Fiber," V. Q. Nguyen, J. S. Sanghera, P. C. Pureza, and I. D. Aggarwal, *J. Lightwave Technology* 21 [1] 122-126, 2003.
16. "Fabrication of Arsenic Selenide Optical Fiber with Low Hydrogen Impurities," V. Q. Nguyen, J. S. Sanghera, P. C. Pureza, F. H. Kung, and I. D. Aggarwal, *J. Am. Ceram. Soc.* 85 [11], 2848-50, 2002.
17. "Applications of Chalcogenide Glass Optical Fibers at NRL," J. S. Sanghera, I. D. Aggarwal, L. B. Shaw, L. E. Busse, P. Thielen, V. Q. Nguyen, P. Pureza, S. Bayya, and F. H. Kung, *J. Optoelectronics and Advanced Materials (Romania)*, vol. 3, no. 3, September 2001, p. 627-640. Edited by INOE & INFM.
18. "Fabrication of Arsenic Sulfide Optical Fiber with Low Hydrogen Impurities," V. Q. Nguyen, J. S. Sanghera, B. Cole, P. C. Pureza, F. H. Kung, and I. D. Aggarwal, *J. Am. Ceram. Soc.*, 85 [8] 2056-58, 2002.
19. "Highly Nonlinear As-S-Se Glasses for All-Optical Switching," J. M. Harbold, F. O. Ilday, F. W. Wise, J. S. Sanghera, V. Q. Nguyen, L. B. Shaw, and I. D. Aggarwal, *Optics Letters*, vol. 27, No. 2, 119-121, January 15, 2002.
20. "Very large temperature-induced absorptive-loss in high Te-containing chalcogenide fibers," V. Q. Nguyen, J. S. Sanghera, F. H. Kung, P. C. Pureza, and I. D. Aggarwal, *J. Lightwave Technology*, vol. 18, no. 10, 1395-1401, Oct. 2000.

21. "Dielectric properties of $\text{As}_{40}\text{S}_{(60-x)}\text{Se}_x$ glass system," V. Q. Nguyen, J. S. Sanghera, I. K. Lloyd, D. Gershon, and I. D. Aggarwal, *J. Non-Cryst. Solids*, vol. 276, no. 1-3, 151-158, Oct. 2000.
22. "Physical properties of Ge-As-Se-Te and Ge-As-Se-Te-I chalcogenide glasses," V. Q. Nguyen, J. S. Sanghera, I. D. Aggarwal, and I. K. Lloyd, *J. Am. Ceram. Soc.* 83 [4] 855-859, 2000.
23. "Development and IR applications of chalcogenide glass optical fibers," J. S. Sanghera, L. B. Shaw, L. E. Busse, V. Q. Nguyen, B. C. Cole, R. Mossadegh, P. Pureza, F. H. Kung, R. Miklos, D. Talley, D. Roselle, B. Harbison, and I. Aggarwal, *Fibers & Integrated Optics* 19 [3], 251-274, 2000.
24. "Structural investigations of chalcogenide and chalcohalide glasses," V. Q. Nguyen, J. S. Sanghera, J. Freitas, I. Aggarwal, and I. K. Lloyd, *J. Non-Cryst. Solids*, vol. 248, no. 2-3, 103-114, 1999.
25. "Effect of temperature on the absorption loss of chalcogenide optical fiber," V. Q. Nguyen, J. S. Sanghera, F. H. Kung, I. D. Aggarwal, and I. K. Lloyd, *J. Applied Optics*, vol. 38, no. 15, 3206-3213, May 20, 1999.
26. "Fabrication of single-mode chalcogenide optical fiber," R. Mossadegh, J. S. Sanghera, D. Schaafsma, B. J. Cole, V. Q. Nguyen, R. E. Miklos, and I. D. Aggarwal, *J. Lightwave Technology*, vol. 16, no. 2, 214-217, Feb. 1998.
27. "Fabrication of long length of low-loss IR transmitting $\text{As}_{40}\text{S}_{(60-x)}\text{Se}_x$ glass fibers," J. S. Sanghera, V. Q. Nguyen, P. Pureza, R. Miklos, F. Kung, and I. Aggarwal, *J. Lightwave Technology*, vol. 14, 743-748, May 1996.
28. "Properties of $\text{As}_{40}\text{S}_{(60-x)}\text{Se}_x$ glasses for IR fiber optics," J. S. Sanghera, V. Q. Nguyen, and I. D. Aggarwal, *J. Am. Ceram. Soc.*, 79 [5] 1324-1328, 1996.
29. "Infrared evanescent-absorption spectroscopy with chalcogenide glass fibers," J. S. Sanghera, F. H. Kung, P. C. Pureza, V. Q. Nguyen, R. Miklos, I. Aggarwal, *Applied Optics*, vol. 33, 6315-6322, 1994.
30. "Fabrication of low-loss IR-transmitting $\text{Ge}_{30}\text{As}_{10}\text{Se}_{30}\text{Te}_{30}$ glass fibers," J. S. Sanghera, V. Q. Nguyen, P. C. Pureza, F. H. Kung, R. Miklos, I. Aggarwal, *J. Lightwave Technology*, vol. 12, 737-741, May 1994.
31. "Measurement of bulk absorption coefficients of chalcogenide and chalcohalide glasses at 10.6 micron using CO_2 laser calorimetry," J. S. Sanghera, V. Q. Nguyen, R. Miklos, I. Aggarwal, *J. Non-Cryst. Solids*, vol. 161, 320-322, 1993.

PUBLICATIONS (NON-REFEREED)

1. "IR Photonic Band Gap Fibers for Missile Defense", I.D. Aggarwal, J.S. Sanghera, D. Gibson, L. Busse, L.B. Shaw, V. Nguyen, P.C. Pureza and F. Kung. NRL Review 2007.
2. "Progress of Chalcogenide Glass Fibers", J.S. Sanghera, L.B. Shaw, P. Pureza, V. Nguyen, D. Gibson, I.D. Aggarwal, and C. Florea. Proc. OFC 2007.
3. "Progress of Chalcogenide Glass Fibers", J.S. Sanghera, L.B. Shaw, P. Pureza, V. Nguyen, D. Gibson, I.D. Aggarwal, C.M. Florea and F. Kung. Proc. Int. Conf. on Optical, Optoelectronic and Photonic Materials and Applications, London UK, July 30th – Aug 3, 2007.
4. "Multispectral Infrared Countermeasures System Demonstrations Using Infrared Optical Fibers",

- L. E. Busse, J. S. Sanghera, V. Q. Nguyen, P.C. Pureza, I. D. Aggarwal and F. H. Kung, NRL Formal Report 10, 142, November 30, 2006 and **winner of 2006 Alan Berman Publication Award**.
5. "Progress of Chalcogenide Glass Fibers", J.S. Sanghera, L.B. Shaw, P. Pureza, V. Nguyen, D. Gibson, I.D. Aggarwal, and C. Florea. Proc. OFC 2007.
 6. "Non-linear Properties of Chalcogenide Glasses and Fibers", J.S. Sanghera, C. Florea, L.B. Shaw, V.Q. Nguyen, P.C. Pureza, M. Bashkansky, Z. Dutton, and I.D. Aggarwal. Proceedings of XI International Conference on Physics of Non Crystalline Solids, Rhodes Island, Greece, Oct. 29th – Nov 3rd, 2006. Accepted for publication in J. Non-Crystalline Solids.
 7. "Non-Linear Effects in Infrared PBG Glass Fibers", I.D. Aggarwal, J.S. Sanghera, L.B. Shaw, P. Pureza, V.Q. Nguyen, D. Gibson, L.E. Busse, C.M. Florea, F.H. Kung. Proc. Photonics 2006 Conference, Hyderabad, India, Dec 13-16, 2006.
 8. "Raman Amplification in As-Se Fiber," L.B. Shaw, P.A. Thielen, P.C. Pureza, V.Q. Nguyen, J.S. Sanghera, L.E. Busse and I.D. Aggarwal. Proc. Solid State Diode Laser Technology Review, Albuquerque, NM, June 8-10, 2004
 9. "Fabrication of As-S and As-Se Optical Fiber with Low Hydrogen Impurities using Tellurium Tetrachloride (TeCl₄)," V. Q. Nguyen, J. S. Sanghera, P. C. Pureza, F. H. Kung, and I. D. Aggarwal, SPIE 4987, 274-283, 2003.
 10. "Raman Amplification in As-Se Fiber," P. A. Thielen, L. B. Shaw, P. C. Pureza, V. Q. Nguyen, J. S. Sanghera, and I. D. Aggarwal, Proc. SPIE Vol. 4628, p. 74-77, March 2002.
 11. "Raman Amplification in As-Se Fiber," L. B. Shaw, P. A. Thielen, P. C. Pureza, V. Q. Nguyen, J. S. Sanghera, and I. D. Aggarwal. Advanced Solid State Lasers, TOPS vol. 68, p. 2002.
 12. "Effect of temperature on the loss of As-S-Se and Ge-As-Se-Te chalcogenide glass fibers," V. Q. Nguyen, J. S. Sanghera, F. H. Kung, P. C. Pureza, R. Miklos, I. D. Aggarwal, and I. K. Lloyd, Proceedings of SPIE Photonic East, SPIE Vol. 4204, 287-299, Nov. 2000.
 13. "Delivery of FEL laser energy at 6.1 micron and 6.45 micron with chalcogenide fibers," L. B. Shaw, L. E. Busse, V. Q. Nguyen, J. S. Sanghera, I. D. Aggarwal, F. H. Kung, R. Mossadegh, D. Jansen, D. Mongin, and G. M. Peavy, Conference of Lasers and Electro-Optics (CLEO 2000), San Francisco, May 2000. Technical Digest. Post conference Edition. TOPS Vol.39. Opt. Soc. America, Salem, MA, USA: 2000; 720 pp., p.502 - 503.
 14. "IR fiber optics development at the Naval Research Laboratory," J. S. Sanghera, L. E. Busse, V. Q. Nguyen, R. Mossadegh, F. H. Kung, B. Cole, L. B. Shaw, P. C. Pureza, R. Miklos, I. D. Aggarwal, and Y. Park. Proceedings of SPIE Photonic West, SPIE Vol. 3950, 180-185, Jan. 2000.
 15. "Infrared optical fibers and their applications," J. S. Sanghera, L. B. Shaw, L. E. Busse, V. Q. Nguyen, B. C. Cole, R. Mossadegh, P. Pureza, R. Miklos, F. H. Kung, D. Talley, D. Roselle, and I. D. Aggarwal, Proceedings of SPIE Photonic East, SPIE Vol. 3849, 38-49, Sept. 1999.
 16. "Magnetically actuated micromirrors with large deflection angle," V. Q. Nguyen and M. Matushskina. Refer to <http://www.isr.umd.edu/Courses/ENMA659S/mems/> May 1998.
 17. "Development of Low Loss IR Transmitting Chalcogenide Glass Fibers," J. S. Sanghera, I. D. Aggarwal, L. Busse, P. Pureza, V. Q. Nguyen, R. Miklos, F. Kung, and R. Mossadegh, Proc. SPIE Vol. 2396, 71-77, 1995.
 18. "Chalcogenide glasses containing tellurium for IR fiber optics," J. S. Sanghera, V. Q. Nguyen, P. C. Pureza, F. Kung, R. Miklos, L. Busse, I. Aggarwal. Proc. SPIE Vol. 2290, 89-97, 1994.
 19. "Immobilization of ash by microwave melting," K. Morita, V. Q. Nguyen, R. Nakaoka, J. D.

PRESENTATIONS

1. "Non-linear Properties of Chalcogenide Glasses and Fibers", J.S. Sanghera, C. Florea, L.B. Shaw, V.Q. Nguyen, P.C. Pureza, F. Kung, D. Gibson, M. Bashkansky, Z. Dutton, and I.D. Aggarwal. XI International Conference on Physics of Non Crystalline Solids, Rhodes Island, Greece, Oct. 29th – Nov 3rd, 2006.
2. "Progress of Chalcogenide Glass Fibers", J.S. Sanghera, L.B. Shaw, P. Pureza, V. Nguyen, D. Gibson, I.D. Aggarwal, and C. Florea. Invited talk at OFC, Anaheim, CA March 25-29, 2007.
3. "Progress of Chalcogenide Glass Fibers", J.S. Sanghera, L.B. Shaw, P. Pureza, V. Nguyen, D. Gibson, I.D. Aggarwal, C.M. Florea and F. Kung. Invited talk at Int. Conf. on Optical, Optoelectronic and Photonic Materials and Applications, London UK, July 30th – Aug 3, 2007.
4. "Non Linear Properties of Chalcogenide Fibers", I.D. Aggarwal, J.S. Sanghera, L.B. Shaw, C. Florea, V.Q. Nguyen, P.C. Pureza, F. Kung, D. Gibson, and L. E. Busse. Invited talk at Indian Photonics Conference, Hyderabad, India, Dec 13-16, 2006.
5. "Progress of Chalcogenide Glass Fibers", J.S. Sanghera, L.B. Shaw, P. Pureza, V. Nguyen, D. Gibson, I.D. Aggarwal, and C. Florea. Invited talk at OFC, Anaheim, CA March 25-29, 2007.
6. "Chalcogenide Glass Optical Fibers," J. S. Sanghera, L. B. Shaw, P. Thielen, V. Q. Nguyen, P. C. Pureza, F. Kung, D. Gibson, S. Bayya and I. D. Aggarwal. Proceedings of the XX International Congress on Glass, Sept 26th – Oct. 1st, 2004, Kyoto, Japan.
7. "Chalcogenide Glass Optical Fibers," J. S. Sanghera, L. B. Shaw, P. Thielen, V. Q. Nguyen, P. C. Pureza, F. Kung, D. Gibson, S. Bayya and I. D. Aggarwal. Invited talk at Int. Cong. Glass, Sept 26th – Oct. 1, 2004, Kyoto, Japan.
8. "Raman Amplification in As-Se Fiber," L.B. Shaw, P.A. Thielen, P.C. Pureza, V.Q. Nguyen, J.S. Sanghera, L.E. Busse and I.D. Aggarwal. Solid State Diode Laser Technology Review, Albuquerque, NM, June 8-10, 2004.
9. "Non-Linear Properties of Chalcogenide Glasses and Fibers," I. D. Aggarwal, J. S. Sanghera, P. Thielen, L. B. Shaw, P. Pureza and V. Nguyen. Invited talk at Am. Ceram. Soc. Indianapolis, IN, April 18 – 21, 2004.
10. "Fabrication and applications of chalcogenide glass fibers," J. S. Sanghera, I. D. Aggarwal, L. B. Shaw, V. Nguyen, P. Pureza, L. E. Busse, P. Thielen, F. Kung and S. Bayya. 10th Int. Conf. on Physics of Non-Crystalline Solids, Parma, Italy, July 13-17, 2003.
11. "Fabrication of As-S and As-Se Optical Fiber with Low Hydrogen Impurities using Tellurium Tetrachloride (TeCl₄)," V. Q. Nguyen, J. S. Sanghera, B. Cole, P. C. Pureza, F. H. Kung, and I. D. Aggarwal. Presented at SPIE Photonics West 2003, San Jose, January 25-31, 2003.
12. "Infrared Materials for Mid-Wave IR Limiting," L. E. Busse, V. Q. Nguyen, J. S. Sanghera, and I. D. Aggarwal. Presented at the Infrared Materials and Modeling Workshop, September 19, 2002, Natick, Massachusetts. Sponsored by Air Force Wright-Patterson Materials Laboratory.
13. "Scanning Near-Field IR Microscopy (SNIM) Using Chalcogenide Glass Fibers," J. S. Sanghera, P. Thielen, L. B. Shaw, P. C. Pureza, V. Q. Nguyen, and I. D. Aggarwal. Presented at the 13th International Symposium on Non-Oxide Glasses and New Optical Glasses, September

14. "Chalcogenide glass development and applications at NRL," I. D. Aggarwal, J. S. Sanghera, L. E. Busse, L. B. Shaw, P. A. Thielen, V. Q. Nguyen, P. C. Pureza, S. S. Bayya, F. H. Kung, and R. Miklos. Invited talk at the 13th International Conference on Non-Oxide Glasses and New Optical Glasses. September 9-13, 2002, Pardubice, Czech Republic.
15. "Non-Linear Properties of Chalcogenide Glasses and Fibers," J. S. Sanghera, P. Thielen, L. B. Shaw, V. Q. Nguyen, I. D. Aggarwal, R. Slusher, J. Hodelin, J. Harbold, F. Ilday, and F. Wise. Presented at the 13th International Symposium on Non-Oxide Glasses and New Optical Glasses, September 9 – 13, 2002, Pardubice, Czech Republic.
16. "Raman amplifications in As-Se fiber," P. A. Thielen, L. Shaw, V. Q. Nguyen, J. S. Sanghera, and I. D. Aggarwal. Presented at SPIE Photonics West 2002, January 19-25, 2002, San Jose, California.
17. "Applications of Chalcogenide Glass Optical Fibers at NRL," J. S. Sanghera, I. D. Aggarwal, L. B. Shaw, L. E. Busse, P. Thielen, V. Nguyen, P. Pureza, S. Bayya and F. Kung. Invited talk at the 1st International Workshop on Amorphous and Nanostructured Chalcogenides, Bucharest, Romania, June 25-29, 2001.
18. "IR applications of chalcogenide glass fibers," J. S. Sanghera, I. D. Aggarwal, L. B. Shaw, L. E. Busse, P. Thielen, V. Q. Nguyen, P. C. Pureza, S. Bayya and F. Kung. Invited talk at the 103rd Annual American Ceramic Society Meeting, Indianapolis, IN, April 22-25, 2001.
19. "Effect of temperature on the loss of As-S-Se and Ge-As-Se-Te chalcogenide glass fibers," V. Q. Nguyen, J. S. Sanghera, F. H. Kung, P. C. Pureza, R. Miklos, I. D. Aggarwal, and I. K. Lloyd. Presented at SPIE Photonics East 2000, Nov. 5-8, 2000, Boston, MA.
20. "Delivery of FEL laser energy at 6.1 micron and 6.45 micron with chalcogenide fibers," L. B. Shaw, L. E. Busse, V. Q. Nguyen, J. S. Sanghera, I. D. Aggarwal, F. H. Kung, R. Mossadegh, D. Jansen, D. Mongin, and G. M. Peavy. Presented at Conference of Lasers and Electro-Optics (CLEO 2000), 7-12 May 2000; San Francisco, CA, USA.
21. "The effect of temperature on the optical loss of sulphide and telluride fibers," J. S. Sanghera, V. Q. Nguyen, F. Kung, P. C. Pureza, and I. D. Aggarwal. Presented at the 12th International Symposium on Non-Oxide Glasses and Advanced Materials, April 10–14, 2000, Florianopolis – S. C., Brazil. (pp. 381-384 in Extended Abstracts).
22. "Scanning near-field IR microscopy (SNIM) using chalcogenide glass fibers," J. S. Sanghera, D. Talley, L. B. Shaw, R. Mossadegh, V. Q. Nguyen, R. Miklos, and I. D. Aggarwal. Presented at the 12th International Symposium on Non-Oxide Glasses and Advanced Materials, April 10–14, 2000, Florianopolis – S. C., Brazil. (pp. 385-388 in Extended Abstracts).
23. "IR fiber optics development at the Naval Research Laboratory," J. S. Sanghera, V. Q. Nguyen, B. Cole, R. Mossadegh, L. E. Busse, L. Shaw, F. H. Kung, P. C. Pureza, R. Miklos, and I. D. Aggarwal. Presented at SPIE Photonics West, January 22-28, 2000, San Jose, California.
24. "Infrared optical fibers and their applications," J. S. Sanghera, L. B. Shaw, L. E. Busse, V. Q. Nguyen, B. Cole, R. Mossadegh, P. C. Pureza, R. E. Miklos, F. H. Kung, D. Talley, D. Roselle, I. D. Aggarwal. Presented at SPIE Photonics East, September 21-22, 1999, Boston, Massachusetts.
25. "New rare-earth doped selenide and telluride glasses and fibers," B. Cole, L. B. Shaw, J. S. Sanghera, B. B. Harbison, P. C. Pureza, R. Miklos, V. Q. Nguyen, R. Mossadegh, D. T. Schaafsma, and I. D. Aggarwal. Presented at the 11th International Symposium on Non-Oxide & New Optical Glasses, September 6–10, 1998, Sheffield, United Kingdom. (p. 155 in Extended Abstracts).
26. "Development of low-loss IR transmitting chalcogenide glass fibers," J. S. Sanghera, I. D.

Aggarwal, L. E. Busse, P. C. Pureza, V. Q. Nguyen, R. Miklos, F. H. Kung, and R. Mossadegh. Presented at SPIE Photonic West, February 7-9, 1995, San Jose, California.

27. "Chalcogenide glasses containing tellurium for IR fiber optics," J. S. Sanghera, V. Q. Nguyen, P. C. Pureza, F. H. Kung, R. Miklos, L. E. Busse, I. D. Aggarwal. Presented at SPIE Annual Meeting, July 28-29, 1994, San Diego, California.
28. "Measurement of bulk absorption coefficients of chalcogenide and chalcogen halide glasses at 10.6 μm using CO_2 laser calorimetry," J. S. Sanghera, V. Q. Nguyen, R. Miklos, and I. D. Aggarwal. Presented at the 8th International Symposium on Halide Glasses, September 22-24, 1992. Perros-Guirec, France. (pp. 161-161 (iv) in Extended Abstracts).